

## **BAETIELLA (EPHEMEROPTERA: BAETIDAE) IN HONG KONG, WITH DESCRIPTION OF A NEW SPECIES<sup>1</sup>**

Xiaoli Tong<sup>2,3</sup>, David Dudgeon<sup>2</sup>

**ABSTRACT:** A new species of *Baetiella* (Ephemeroptera: Baetidae), *B. trispinata*, from Hong Kong, China is described and illustrated based on adult and larval material. The first adult description of *B. pseudofrequenta* (Müller-Liebenau) and new distributional records for *B. bispinosa* (Gose) and *B. pseudofrequenta* in China are provided.

*Baetiella* Uéno is a poorly defined genus distributed in the Palearctic and Oriental Regions. The genus frequently has been considered as a subgenus of *Pseudocloeon* (e.g., Kazlauskas, 1963; Braasch, 1978; Kluge, 1983), a synonym of *Pseudocloeon* (e.g., Gose, 1980; Müller-Liebenau, 1985), or treated as *Baetis* (e.g., Kazlauskas, 1963; Braasch, 1978; Müller-Liebenau, 1985). Waltz and McCafferty (1987) gave a generic diagnosis for *Baetiella* and listed 12 species within the genus. The genus is now clearly known to be distinct from *Pseudocloeon* (Lugo-Ortiz, McCafferty and Waltz, 1999). Waltz and McCafferty (1997) added three species to the genus that had been placed in *Baetis* (*Tenuibaetis*) by Kang et al. (1994). In this paper, a new species of *Baetiella*, *B. trispinata*, from Hong Kong, China is described based on adult and larval material. The first adult description of *Baetiella pseudofrequenta* and new distributional records for *B. bispinosa* (Gose) and *B. pseudofrequenta* (Müller-Liebenau) in China are also provided.

Abbreviations used for deposition of types are as follows: the insect collection of the South China Agricultural University, Guangzhou, P. R. China (SCAU); Department of Ecology & Biodiversity, The University of Hong Kong (HKU); the insect collection of the Agriculture and Fisheries Department of Hong Kong Government (AFDHK); the collection of Florida A & M University, Tallahassee, Florida (FAMU); and Purdue Entomological Research Collection, West Lafayette, Indiana (PERC).

### ***Baetiella bispinosa* (Gose, 1980)**

*Pseudocloeon bispinosus* Gose, 1980: 211.

*Neobaetiella macani* Müller-Liebenau, 1985: 108.

*Neobaetiella imanishii* Müller-Liebenau, 1985: 108, fig. 19.

*Baetiella bispinosa* (Gose): Waltz and McCafferty, 1987: 563.

<sup>1</sup> Received July 14, 1999. Accepted September 24, 1999.

<sup>2</sup> Department of Ecology & Biodiversity, The University of Hong Kong, Pokfulam Road, Hong Kong SAR, China.

<sup>3</sup> Present address: College of Resources and Environment, South China Agricultural University, 510642, Guangzhou, Guangdong Province, P. R. China.

**Larva.** Adequately described and illustrated by Müller-Liebenau (1985).  
**Adult.** Unknown.

**Material examined.** CHINA: Hong Kong: 4 larvae, Lantau Island, Shek Mun Kap, 17-XII-1996, XiaoLi Tong, in HKU; 1 larva, Hok Tau, 18-X-1998, XiaoLi Tong, in AFDHK. CHINA: Guangdong Province: 1 larva, Nankunshan Nature Reserve, near the Middle School, 16-IX-1994, XiaoLi Tong, in SCAU; 2 larvae, Nankunshan Nature Reserve, Stone River, 11-III-1995, XiaoLi Tong, in SCAU; 11 larvae, Yangshan, Chengjia Nature Reserve, Lutian, 15-VII-1996, XiaoLi Tong, in SCAU.

**Distribution:** Japan; China: Guangdong, Hong Kong and Taiwan.

*Baetiella pseudofrequenta* (Müller-Liebenau, 1985)

(Figs. 15-20)

*Baetis pseudofrequentus* Müller-Liebenau, 1985: 98.

*Baetis* (*Tenuibaetis*) *pseudofrequentus* Müller-Liebenau: Kang et al., 1994: 26.

*Baetiella pseudofrequenta* (Müller-Liebenau): Waltz and McCafferty, 1997: 136.

**Larva.** Adequately described and illustrated by Müller-Liebenau (1985) and Kang et al. (1994).

**Male adult** (in alcohol, reared from larvae in the laboratory). Body length 4.1 mm, forewing 4.4 mm; cerci 10.0 mm. Turbinate eyes well developed (Figs. 19-20), orange with light cream margins apically. Antennae shorter than head capsule; flagella gray; pedicels light yellow; scapes light yellow with rust colored markings basely. Meso- and metanota pale or gray-yellow dorsally and dark brown laterally; thorax ventrally dark brown. Forewings (Fig. 18) hyaline; longitudinal veins and paired marginal intercalaries gray; pterostigma areas with 5-7 slanting veinlets. Hindwings (Fig. 15) with acute costal process and two longitudinal veins. Forefemora straw colored with rust preapical markings (Fig. 17); foretibiae and foretarsi gray. Length of foreleg segments (mm): femora 7.80, tibiae 1.00, tarsal segments 0.08, 0.38, 0.29, 0.18, and 0.12. Other legs gray or light gray-yellow. Abdominal terga 1-6 translucent, whitish to light yellow dorsally and with rust colored markings laterally; terga 7-8 light brown-green; terga 9-10 whitish; terga 1-9 with single purple-red transverse streak posteriorly. Genital forceps (Fig. 16) with basal segments 1-2 whitish; terminal segments 3-4 gray-brown. Cerci gray with purplish annulations at apex of each segment.

**Female adult** (in alcohol, reared from larvae in the laboratory). Body length 3.5 mm; forewing 4.4 mm; cerci 7.8 mm. Vertex light yellow or yellow. Pronotum with red-brown streak anteriorly, a pair of oblique red-brown dashes submedially. Thorax except foreleg as in male. Abdominal terga 1-10 whitish to yellow dorsally, light brown-green tinted rust laterally. Cerci as in male.

**Material examined.** CHINA: Hong Kong: 2 larvae, Shing Mun, 12-XI-1996, XiaoLi Tong, in HKU; 4 larvae, Tai Po Kau Forest Stream, 19-XI-1996, XiaoLi Tong, in SCAU; 91 larvae, Lam Tsuen River near Tong Min Tsuen, 6-I-1997, XiaoLi Tong, in SCAU; 36 larvae, Pak Ngau Shek, 13-I-1997, Maria Salas, in HKU; 2 larvae, Ma Po Mei near Lam Kam Road, 7-X-1997, XiaoLi Tong, in HKU; 56 larvae, 5 male adults and 4 female adults, Ha Wan Yiu, 4-XI-1997, XiaoLi Tong, in SCAU; 2 larvae, Tan Shan River near Ng Uk, 13-II-1998, XiaoLi Tong, in AFDHK; 4 larvae, Tan Chuk Han, 18-III-1998, XiaoLi Tong, in HKU; 14 larvae, Ho Chung, 1-

IV-1998, Xiaoli Tong, in HKU; 2 male and 2 female adults, Nam Chung River, near Luk Keng Lam Uk, 5-III-1999, Xiaoli Tong, in SCAU.

**Distribution.** China: Hong Kong and Taiwan.

*Baetiella trispinata* Tong & Dudgeon, NEW SPECIES

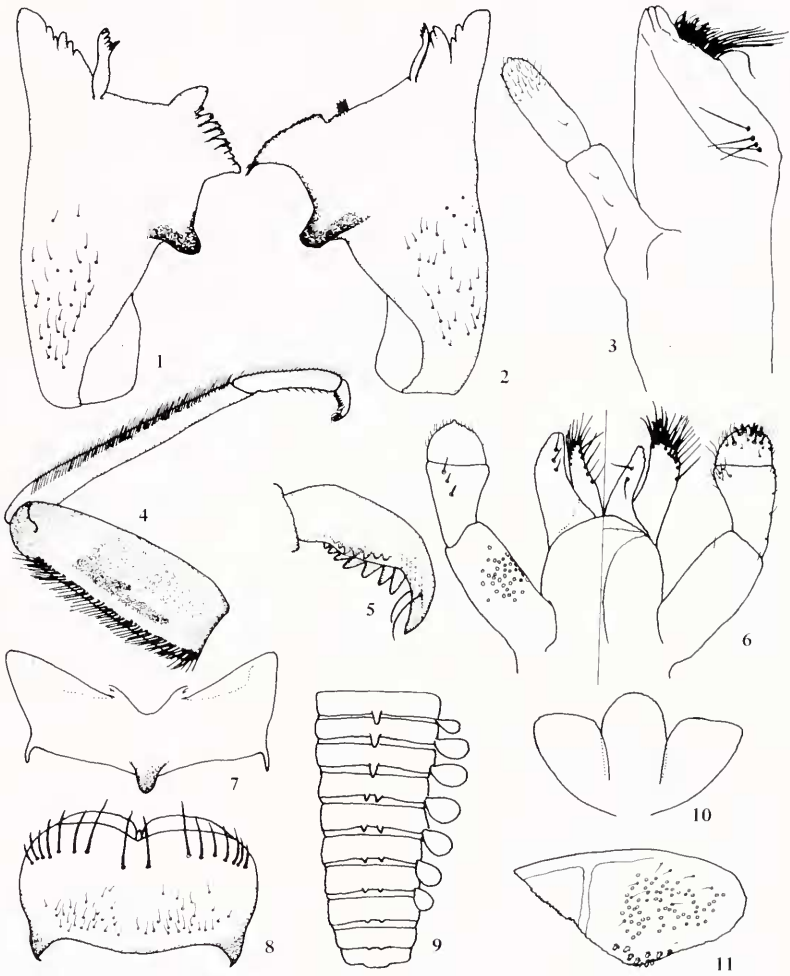
(Figs. 1-14, 21-22)

**Larva.** Body length 4.6-5.4 mm; cerci 5.0-7.0 mm. Head: Head capsule yellow-brown. Labrum (Fig. 8) approximately 2.0 times wider than long, deeply cleft anteromedially, dorsally with submedial pair of long, robust, simple setae and anterior submarginal row of 7-8 long, robust, simple setae. Hypopharynx as in Figure 10. Left mandible (Fig. 1) with incisors with 6 denticles; marginal lateral denticle enlarged. Right mandible (Fig. 2) with incisors with 6 denticles; marginal lateral denticle enlarged. Maxillae (Fig. 3) with 4 denticles on galealacinae and 4-5 fine, simple setae on medial hump; maxillary palpi 2 segmented; terminal segment with small apical tip. Labial palpi (Fig. 6) 3 segmented; terminal segment conical, with tiny apical tip.

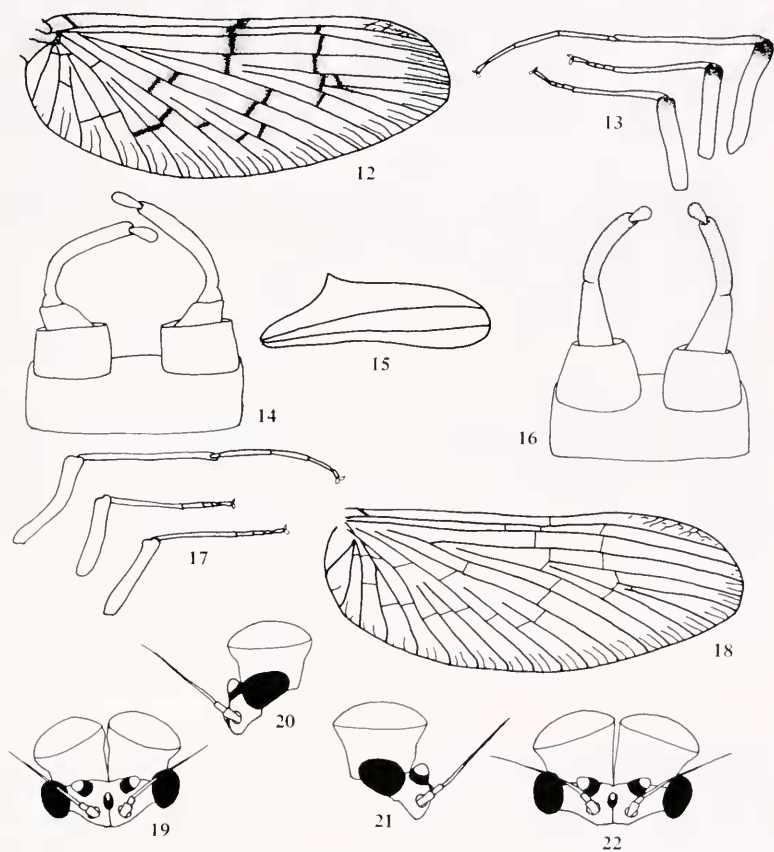
**Thorax:** Thorax yellow-brown, with irregular brown markings medially; mesonotum with two longitudinal, yellow narrow stripes on both sides near median line. Pro- and mesonota with numerous tubercles. Metanotum (Fig. 7) with single long tubercle medially. Hindwing pads (Fig. 7) reduced, approximately 2-3 times longer than wide. Legs (Fig. 4) paler than thorax, femora with brown longitudinal markings on dorsal surface and with row of long, relatively robust, simple setae dorsally; tibiae with row of dense, fine, simple setae dorsally; tarsi with row of sparse, fine, simple setae dorsally. Tarsal claws (Fig. 5) with subapical pair of long, fine, simple setae and 2 rows of 7-8 denticles (one of the rows vestigial). All legs lacking coxal gills. **Abdomen:** Generally yellow-brown, with medium brown to brown markings. Segments 2-6 with pair of oblique brown dashes anteriorly, segments 7-9 with pair of small specks in anterior half. Posterior margins of terga 1-3 with single median dorsal tubercles; terga 4-9 with paired dorsal tubercles posteriorly, decreasing in size towards abdomen, on tergum 9 dorsal tubercles reduced (Fig. 9). Gills whitish and untracheated, present on segments 1-7; gill surface with numerous pores, margin smooth with fine, simple setae. Paraprocts as in Figure 11. Cerci yellow-brown; median terminal filament reduced to one segment.

**Male adult** (in alcohol, reared from larvae in the laboratory). Body length 4.0-4.8 mm, forewing 4.4-4.8 mm, cerci 11.5 mm. Head yellow-brown. Antennae approximately 1.5 times length of head capsule; flagella pale brown; scapes yellow-brown; pedicels red-brown. Upper portion of compound eyes orange, extremely large (Figs. 21-22); lower portion black. Ocelli whitish with black basal rings. Thorax light brown. Forewings (Fig. 12) hyaline, basal portions and pterostigma areas tinted with brown; longitudinal veins and paired marginal intercalaries light brown, with distinctly brown pigmented areas adjoining and including crossveins. Hindwings absent. Legs (Fig. 13) whitish, femora with brown marking apically; foretibiae with light brown basal macula. Length of foreleg segments (mm): femora 1.00, tibiae 1.50, tarsal segments 0.08, 0.50, 0.45, 0.27, and 0.15. Abdominal segments 1-6 opaque, cream; segments 7-10 light brown; terga 1-9 with single pale brown streak posteriorly. Genital forceps (Fig. 14) whitish, arched. Cerci whitish. **Female adult** (in alcohol, reared from larvae in the laboratory). Body length 4.4 mm, forewing 5.0 mm. Head yellow-brown; flagella light purple-red; scapes light yellow; pedicels purple-red. Pronotum light yellow-brown with 3 longitudinal brown markings. Abdominal terga 1-7 and 10 yellow-brown; terga 8-9 yellow. Other characters as in male except for the usual sexual differences.

**Material examined.** Holotype: Mature male larva (in alcohol), CHINA, Hong Kong: Ma Po Mei, Lam Tsuen River near Lam Kam Road, 29-X-1997, Xiaoli Tong, in SCAU. Paratypes (in



Figs. 1-11. Larva of *Baeñiella trispinata*, new species. 1. Left mandible. 2. Right mandible. 3. Maxilla. 4. Foreleg. 5. Tarsal claw. 6. Labium. 7. Metanotum. 8. Labrum. 9. Abdominal terga. 10. Hypopharynx. 11. Paraproct.



Figs. 12-14, 21-22. Adult of *Baetiella trispinata*, new species. 12. Forewing. 13. Legs. 14. Genitalia. 21. Head, lateral view. 22. Head, anterior view.

Figs. 15-20. Adult of *Baetiella pseudofrequenta* (Müller-Liebenau) 15. Hindwing. 16. Genitalia. 17. Legs. 18. Forewing. 19. Head, anterior view. 20. Head, lateral view.

alcohol), CHINA, Hong Kong: 1 female, 2 male adults and 7 larvae, locality and date as holotype, in SCAU; 1 larva, Ng Tung Chai, 25-II-1997, Xiaoli Tong, in AFDHK; 2 larvae, Shing Mun, 27-VIII-1997, Xiaoli Tong, in HKU; 2 larvae, Ma Po Mei, Lam Tsuen River near Lam Kam Road, 22-X-1997, Xiaoli Tong, in HKU; 9 larvae, Lantau Island, Pui O, near Water Station, 23-VI-1998, Xiaoli Tong, 5 in PERC, 4 in FAMU; 2 larvae, Tai Po Kau Forest Stream, 25-II-1999, Xiaoli Tong, in SCAU. CHINA, Guangdong Province: 6 larvae, Nankunshan Nature Reserve, near the Middle School, 16-IX-1994, Xiaoli Tong, in SCAU; 2 larvae, Nankunshan Nature Reserve, Stone River, 11-III-1995, Xiaoli Tong, in PERC; 3 larvae, Yangshan, Chengjia Nature Reserve, Lutian, 15-VII-1996, Xiaoli Tong, in SCAU.

**Etymology.** The epithet *trispinata* is from the Latin words: *tri-* meaning three and *spinatus* meaning having spines, thus referring to abdominal terga 1-3 of the larvae having 3 median dorsal tubercles.

**Distribution.** China: Hong Kong and Guangdong Province.

**Remarks.** The larva of *Baetiella trispinata* can be distinguished from all other species of *Baetiella* by the following combination of characters: (1) posterior margin of metanotum having a single long tubercle medially; (2) hindwing pads present; (3) legs lacking coxal gills; (4) abdominal terga 1-3 having a single median dorsal tubercle and terga 4-9 having a pair of dorsal tubercles posteriorly, decreasing in size towards abdominal end; (5) the gills present on abdominal segment 1-7; and (6) median terminal filament reduced to one segment.

#### ACKNOWLEDGMENTS

We thank W. P. McCafferty (Purdue University, West Lafayette, USA) for reviewing the manuscript, and two anonymous reviewers for their helpful comments.

#### LITERATURE CITED

- Braasch, D. 1978. Baetidae (Ephemeroptera) in Mittelasien I. Entomol. Nachr. 22: 17-23.
- Gose, K. 1980. The mayflies of Japan. Key to the families, genera, and species. Part 7. Kaiyuo to Seibutsu 2: 211-215.
- Kang, S.-C., H.-C. Chang, and C.-T. Yang. 1994. A revision of the genus *Baetis* in Taiwan (Ephemeroptera, Baetidae). J. Taiwan Mus. 47: 9-44.
- Kazlauskas, R. 1963. New and little known mayflies from the USSR. Entomol. Rev. 42:582-593.
- Kluge, N. Yu. 1983. New and little known mayflies of the family Baetidae (Ephemeroptera) from the Primor'ye. Entomol. Rev. 62: 53-68.
- Lugo-Ortiz, C. R., W. P. McCafferty and R. D. Waltz. 1999. Definition and reorganization of the genus *Pseudocloeon* (Ephemeroptera: Baetidae) with new species descriptions and combinations. Trans. Am. Entomol. Soc. 125: 1-37.
- Müller-Liebenau, I. 1985. Baetidae from Taiwan with remarks on *Baetiella* Ueno, 1931 (Insecta, Ephemeroptera). Arch. Hydrobiol. 104: 93-110.
- Waltz, R. D. and W. P. McCafferty. 1987. Systematics of *Pseudocloeon*, *Acentrella*, *Baetiella*, and *Liebebiella*, new genus (Ephemeroptera: Baetidae). J. New York Entomol. Soc. 95: 553-568.
- Waltz, R. D. and W. P. McCafferty. 1997. New generic synonymies in Baetidae (Ephemeroptera). Entomol. News 108: 134-140.